U. S. DEPARTMENT OF COMMERCE

# Technical News Bulletin

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CONTENTS



### TEXTILE RESEARCH INSTITUTE

The efforts to establish a central organization for textile research in the United States, which have gradually gathered support over a period of years, and in which the Bureau has played an important part, were crystallized at the annual meeting of the Textile Research Institute in New York on November 18. The plan of the Institute outlined at that meeting provides for: (1) Coverage of all branches of the textile industry and all fibers; (2) location of the Institute's laboratories near New York; (3) development of a program covering fundamental research, applied research, a graduate school, and information service, etc.; (4) raising of a research fund of $300,000 a year for 5 years, or $1,500,000, plus a capital fund of $500,000.

Milton Harris, director of research for the Textile Foundation at the Bureau, is to serve also as director of research for the Institute. William D. Appel, chief of the Bureau's textile section, is chairman of the Applied Research Committee of the Institute, and a member of the Board of Directors.

### OIL AND WAX TREATMENTS OF SOLE LEATHER

The possibility of using oil and wax treatments commercially to improve the wear of sole leather is receiving increased attention as a result of service tests conducted by the Bureau's leather section, as part of a cooperative project of the Interdepartmental Committee on Leather. These tests, which are described in Letter Circular LC739, showed that resistance to wear was increased about 15 percent by treating the soles with a mixture of mineral oil and solvent, and as much as 30 to 40 percent by impregnation with hot wax. It has been demonstrated that these treatments can be used satisfactorily on soles that are to be stitched or nailed to the shoes, either by the manufacturer or the repairer. (Stitched or nailed soles are used on about 250,000,000 pairs of new shoes each year in this country.) The practicability of using these treatments on soles that are to be cemented to the uppers has been uncertain, because the bond between sole and upper has been rendered insecure when the sole is treated. (Cemented soles are used on about 150,000,000 pairs of shoes annually.) Preliminary tests by other members of the Interdepartmental Committee indicate that the treatments can be used satisfactorily with this type of construction by roughening and applying adhesive to the portion of the sole that is to be cemented, allowing it to dry, and then applying the treatment.

Copies of LC739 are obtainable without charge from the National Bureau of Standards, Washington 25, D. C.

[1] Published with approval of the Director of the Budget.

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## NATURAL RUBBER AND SYNTHETIC RUBBER

In an address on November 5, 1943 at the Instituto Agronomico do Norte, in Belem, Para, Brazil, Norman Bekkedahl discussed natural rubber and synthetic rubber from the point of view of the research worker familiar with the advantages and disadvantages of both materials. His conclusion is, that there will always be a field for the natural product, particularly if its quality is improved through research. He feels certain that this can be accomplished—in fact, this is the primary object of the work of the rubber laboratory which he is directing at Belem while on loan by the Bureau to the Brazilian Government.

Thus, in the case of automobile tires, which before the war absorbed over 50 percent of the world's output of rubber, natural rubber has one advantage—under most circumstances it does not convert into heat so large a proportion of the mechanical energy produced by flexing the tire as does synthetic rubber. Perhaps a tire made from a combination of natural and synthetic rubber will ultimately be adopted.

The paper discusses the development of the synthetic rubber industry and points out that it was not until the attempts to produce artificial rubber having the same chemical composition as natural rubber were given up, that commercial success was achieved. Some of the synthetic rubbers now in production are not hydrocarbons at all, and because they are not, they possess certain valuable properties. Thus they are resistant to petroleum and, hence, are widely used in the manufacture of gasoline hose, gaskets, and other products. Moreover, the so-called Neoprene rubbers contain such a high percentage of chlorine that they will not burn, giving them a great advantage for use in places where fire hazards must be avoided.

All the synthetic rubbers are better able to absorb vibrational energy than natural rubber, so that they are ideal as a material for blocks or pads to place under or between parts of machines. On the other hand, this mechanical energy is converted into heat and this, as already mentioned, is a disadvantage which must be overcome in the building of tires.

Almost certainly the demand for rubber will increase after the war. New uses will develop and some of these can best be met by natural rubber. Every effort should be made to improve its quality. There is a possibility that varieties of trees exist that can produce more and better rubber than the customary Hevea brasiliensis. New hybrids can be grown that will show increased resistance to disease, and the rubber from many varieties of plants, now but little known, should be investigated. There is no reason to be pessimistic over the future of natural rubber.

Copies of Dr. Bekkedahl's paper are obtainable from the Instituto Agronomico do Norte, Belem, Para, Brazil. Notes on the Brazilian rubber laboratory will be found in Technical News Bulletins 308 and 316 (December 1942 and August 1943).

## LIQUID DENSITIES OF HYDROCARBONS

Tables giving the liquid densities of 11 hydrocarbons found in commercial $C_4$ hydrocarbons have been compiled by Carl S. Cragoe of the Bureau's heat measurements section, and are now available in mimeographed form as Letter Circular LC736. This information was requested by the Rubber Reserve Co. to expedite commercial transactions involving hydrocarbons used in the production of butadiene for synthetic rubber manufacture.

The tables include seven $C_4$ compounds (*n*-butane, isobutane, 1-butene, *cis*–2–butene, *trans*–2–butene, isobutene, and 1.3-butadiene), two $C_3$ hydrocarbons (propane and propene), and two $C_5$ hydrocarbons (*n*-pentane and isopentane). The $C_3$ and $C_5$ hydrocarbons are included, because they are usually present to a minor extent in the $C_4$ fraction.

The densities are calculated from equations in which the sum of liquid and vapor densities at saturation is assumed to be a linear function of temperature. There are three separate tables in different units—grams per milliliter, pounds per gallon, and density ratios relative to density at 60° F. The temperature range extends from −50° to +140° F. with values for every 1 degree from 0° to 120° F, and for every two degrees outside this interval.

Those having a real need for these tables should write to Albert E. Miller, secretary, executive branch, Technical Advisory Committee, Petroleum Industry War Council, 50 West 50th St., New York, N. Y.

## HYDROCARBONS IN THE GASOLINE FRACTION OF PETROLEUM

Research Paper RP1571 in the January number of the Journal of Research, by A. F. Forziati, C. B. Willingham, B. J. Mair, and F. D. Rossini, was originally

presented on November 10, 1943, before the division of refining at the annual meeting of the American Petroleum Institute in Chicago. This is the second report of an investigation on the analysis of the gasoline fraction of representative crude petroleums by the API Research Project 6 at the Bureau. The samples for analysis were selected so as to cover the largest possible range in composition; they included one high in aromatics, one high in isoparaffins, one high in normal paraffins, and one high in naphthenes (cycloparaffins), and came from the following fields: Ponca, Okla.; East Texas; Bradford, Pa.; Greendale-Kawkawlin, Mich.; Winkler, Tex.; Midway, Calif.; Conroe, Tex. The fractionating processes of adsorption and distillation were used in analysis.

Data are given on the amounts of the individual hydrocarbons (paraffins and naphthenes, 40° to 102° C, and aromatics to 160° C) in the gasoline fraction of the seven naphthas. A number of conclusions have been drawn from the data, as follows:

1. The gasoline fraction of different crudes may be characterized by specifying the relative amounts of the following five classes of hydrocarbons: Normal paraffins, isoparaffins, alkyl cyclopentanes, alkyl cyclohexanes, and aromatics.

2. These gasoline fractions are composed of the same hydrocarbons; the essential difference between them is in the relative amounts of the foregoing five classes of hydrocarbons which they contain.

3. Within each of these five classes, the individual hydrocarbons occur in proportions which are of the same order of magnitude for different naphthas.

4. It appears possible to predict the order of magnitude of the amounts of the individual hydrocarbons, paraffins, and naphthenes, 40° to 102° C, and aromatics to 160° C, present in an appropriate fraction of a given naphtha when there are known the relative amounts of the foregoing five classes of hydrocarbons, or, alternatively for each class, the amount of one of the main components of that class.

## HOW TO SAVE DOMESTIC FUEL OIL

The value of a fireplace in relieving the load on the main heating plant of the usual dwelling house is brought out in Letter Circular LC738, "Notes on domestic fuel oil conservation," which has been prepared to answer the numerous inquiries received at the Bureau on this subject. Although sometimes inefficient, fireplaces do supply a certain amount of heat, which in the case of a good design and location, may appreciably reduce the oil consumption and even the total heating cost. A good stove may be more efficient, since the loss of heat up the chimney is generally less than in the case of a fireplace.

If a fireplace is not in use, the damper should be closed, or if there is no damper, the flue opening should be covered. A very small fire in a fireplace may actually cool a room because the fire will increase the draft up the chimney, and hence the escape of warm air from the room and will throw out but little heat. In other words, a certain minimum fire must be burned to heat a room, and this can be determined only by experiment.

A "tight" house cuts down oil consumption, but if a room is too tightly closed, the fireplace may smoke. Weather stripping, window-sealing materials, storm windows and doors are all valuable in keeping heat inside a house, and hence in reducing the amount of oil burned, but a certain amount of ventilation is essential and the heat loss that goes with it is unavoidable. Turning down the thermostat at night or when the house is unoccupied saves fuel, as explained in a previous Letter Circular, LC711. Often one or more occupied rooms can be kept at a comfortable temperature by using a fireplace or stove in combination with the main heating plant, while the rest of the house is maintained at a uniform lower temperature by the heating plant alone.

Copies of LC738 are obtainable without charge from the National Bureau of Standards, Washington 25, D. C.

## PAPER TAGS FOR STOCK AND SHIPPING PURPOSES

The following information, prepared by B. W. Scribner, chief of the Bureau's paper section and chairman of the paper committee for Federal Specifications, is of interest as illustrating the efforts that are being made by the National Government and cooperating manufacturers to conserve critical materials in every way possible in the Government's purchase of commodities.

Amendment 2 to the Federal Specification for stock and shipping tags, recently issued, eliminates vulcanized fiber and metal rims from the stock tags, and cloth, metal, and abaca manila hemp fiber from the shipping tags. All of these are critical materials.

Satisfactory substitute products have been developed by manufacturers of tags and of tagboard, working in cooperation with the Bureau, which assisted with testing and advice.

Both the Army and Navy use large quantities of the stock tags in their depots for identification of stock bins, and they must withstand considerable wear. Formerly, wood-fiber tags with metal rims were used, but when the rims were eliminated, a stronger tagboard was necessary, and this problem was solved with exceedingly tough board made from vulcanized fiber. When this type of board became no longer available, a wood-fiber board of almost equal endurance was developed and adopted.

The replacement of cloth tags for general shipping purposes and of metal tags on shipments of steel articles presented a very difficult problem. Their use for overseas shipments makes necessary not only a very high initial resistance to tearing and scuffing, but the retention of a large part of this resistance when wet. Tagboard manufacturers developed substitute boards in which noncritical fibers replace the manila hemp and which have high wet strength and resistance to scuffing imparted by the use of synthetic resin. The tearing resistance of this board when dry is equal to that of the manila hemp board and, what is more remarkable, increases when the board is wetted. Even when the new type of board is saturated with water, it has appreciable greater tearing resistance than when dry. The increase in resistance to scuffing secured by the use of the synthetic resin is equally remarkable.

The metal eyelets of the shipping tags were replaced with paper patches affixed with water-resistant adhesives. The patches withstand immersion in water indefinitely without coming loose from the tags.

## REFRACTIVITY OF OPTICAL GLASS

The manufacture of optical glass in large quantities for precision uses necessitates many measurements of refractive index that cannot be made with needed accuracy on refractometers. The time required for the precise computation of indices after measurements of minimum deviation on prisms of various angles near 60° is materially shortened, and the chances of error are reduced by using special tables and a slide rule instead of logarithms or a computing machine. Helen L. Gurewitz and Leroy W. Tilton have prepared one such table by merely doubling the values read from a table of natural sines at intervals of 15 seconds of arc. This is really a table of refractive indices for a prism of exactly 60° listed as a function of (double) deviation. A second table of auxiliary coefficients has been prepared for changing the actually observed (double) deviation for any prism of 60° ±30′ to the corresponding (double) deviation for a prism of exactly 60°. This permits the first table to be used for all prisms in the range 60° ±30′. Copies of these tables and a discussion of methods for determining refractive index and dispersion of optical glass so as to control its quality will be published as RP1572 in the January number of the Journal of Research.

## ALKALI ETCHING TESTS ON CONCRETE AGGREGATES

Reaction between certain types of aggregate and the alkalies in some cements has been suggested as a cause of a type of expansive disintegration of concrete. As a part of a general study at the Bureau of the properties of concrete aggregate materials, alkali etching tests were made by Willard H. Parsons and Herbert Insley on various aggregate constituents that have been blamed as reactive. Polished specimens of rocks and minerals were immersed in various alkali hydroxide and sulfate solutions for periods of time from 20 minutes to 9 months and then examined microscopically for evidence of reaction or etch of the polished surface. Opal in various forms was etched very readily and volcanic glass, chalcedony, some feldspars, calcite, and dolomite were etched slightly under certain conditions.

A simple test for detecting potential reactivity of a concrete aggregate with the alkalies in cement is to immerse the polished specimens in a 10-percent NaOH solution at 50° C for 18 to 24 hours. This makes possible the detection of potentially reactive aggregates in a few hours, whereas several months are required by present methods. The test has been applied to several commercial concrete aggregates that proved bad in service, and the polished surfaces of most of them were considerably etched.

A paper in the Journal of the American Concrete Institute describes the etching procedure used to identify suspected minerals and rocks and the suggested test for aggregate reactivity.

## DICALCIUM SILICATE SOLID SOLUTIONS

The manner of combination of sodium oxide in portland cement clinker is the subject of a series of investigations at the Bureau. In certain experimental preparations made in the course of this work, crystalline phases have been observed that, although known to be composed almost entirely of dicalcium silicate ($2CaO.SiO_2$), yet exhibit optical properties differing from those of the $2CaO.SiO_2$ of commercial clinker. These phases result when samples of $2CaO.SiO_2$ to which small amounts of $Na_2O$ and $Al_2O_3$ or of $Na_2O$ and $Fe_2O_3$ have been added are quenched from temperatures of 1,450° to 1,500° C.

The nature of these crystalline phases has been studied by optical, thermal, and X-ray diffraction methods, and is reported in a paper by Kenneth T. Greene in the Journal of Research for January (RP1570). The data indicate that, at high temperatures, $Na_2O$ plus $Al_2O_3$, or $Na_2O$ plus $Fe_2O_3$, enter into solid solution in the $2CaO.SiO_2$, producting phases which are metastable at room temperature but which may be preserved by quenching. These metastable solid solutions have hexagonal crystal structures, and evidence was obtained that this hexagonal lattice is fundamental for the $\alpha$ form of $2CaO.SiO_2$. In one of these preparations the $\alpha$-$\beta$ inversion temperature of $2CaO.SiO_2$ is lowered from 1,420° C. to $1{,}175 \pm 10$° C, and in another to $1{,}180° \pm 10$° C.

When the hexagonal phases invert to the $\beta$ form, the material in solid solution is precipitated as minute inclusions, causing the grains of $2CaO.SiO_2$ to resemble those in some commercial clinkers. Many of the grains also exhibit a complex twinning structure similar to that often observed on the $2CaO.SiO_2$ of commercial clinker. The data indicate that this twinning is produced by the inversion from the $\alpha$ to the $\beta$ phase.

## COMMERCIAL STANDARD FOR EARTHENWARE (VITREOUS-GLAZED) PLUMBING FIXTURES

Commercial Standard CS111–43 on earthenware (vitreous-glazed) plumbing fixtures, which has just been released, represents a voluntary standard of the trade developed by those directly concerned under the auspices, and with the cooperation of the Bureau.

It records general requirements for the body and glaze; limitations of blemishes and defects; methods of inspection and test for warpage, crazing, thermal shock, absorption, modulus of rupture and reflectance; as well as definitions and a uniform guarantee label declaring compliance with the standard. It provides a nationally accepted method of distinguishing between ware which, according to composite experience, may be expected to give good service and that which may not, as well as a basis for fair competition and for better understanding between buyers and sellers.

Vitreous-glazed earthenware has a porous body specially suitable for large plumbing fixtures, such as bath tubs, kitchen sinks, laundry trays, mortuary slabs, and large fixtures for hospital use. The glaze is exactly the same as that used for vitreous china, having a high gloss and being easily cleanable. The ware is somewhat lighter than the older types of porcelain (all-clay) plumbing fixtures, and is expected eventually to supersede the older types.

The standard became effective for new production on October 15, 1943. Copies are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 5 cents each.

## THE PLACE OF BUILDING CODES IN URBAN DEVELOPMENT

A pamphlet entitled "Building codes, an essential tool in urban development," has recently been issued by the Chamber of Commerce of the United States. The pamphlet contains a foreword by E. F. Pulmer, chairman of the Construction and Civic Development Department of the Chamber, and a discussion of the importance of building codes, prepared at the request of the Chamber by George N. Thompson, chief of the building codes section of the Bureau.

In the foreword, attention is called to the need for examining local building codes and for revising them where necessary in the light of latest developments in the construction field. In the discussion that follows, the effect of good and bad requirements on urban development is described. Attention is called to the fact that building-code requirements should not be hastily improvised after some great disaster nor be gradually whittled down in response to demands for economy at the expense of safety, but should be the product of balanced judgment. It is pointed out that, although the public is scarcely aware of the existence of such requirements, nevertheless their silent protective influence

is always present and is of greater importance than is generally appreciated.

## NEW AND REVISED PUBLICATIONS ISSUED DURING DECEMBER 1943

### Journal of Research[2]

Journal of Research of the National Bureau of Standards, volume 31, number 6, December 1943 (RP1567 to RP1569, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

### Research Papers[2]

[Reprint from the September, October, and November 1943 Journal of Research]

RP1553. Properties of cast red brass as affected by the ambient atmosphere during melting. Harold B. Gardner, Alexander I. Krynitsky, and Charles M. Saeger, Jr. Price 10 cents.

RP1554. Electrical and mechanical properties of the system Buna-S-gilsonite. Alan H. Selker, Arnold H. Scott, and Archibald T. McPherson. Price 10 cents.

RP1557. A counting method for the determination of small amounts of radium and of radon. Leon F. Curtiss and Francis J. Davis. Price 10 cents.

RP1559. The second dissociation constant of *p*-phenolsulfonic acid and pH values of phenolsulfonate-chloride buffers from 0° to 60° C. Roger C. Bates, Gerda L. Siegel, and S. F. Acree. Price 10 cents.

RP1560. X-ray patterns of hydrated calcium silicates. Howard F. McMurdie and Einar P. Flint. Price 5 cents.

RP1561. Structure of the wool fiber as revealed by the electron microscope. Charles W. Hock and Howard F. McMurdie. Price 10 cents.

RP1562. A friction meter for determining the coefficient of kinetic friction of fabrics. Edwin C. Dreby. Price 5 cents.

RP1563. Abrasion and solution of teeth. Wilmer Souder and Irl C. Schoonover. Price 10 cents.

RP1564. Report on the systems lead oxide-alumina and lead oxide-alumina-silica. R. F. Geller and E. N. Bunting. Price 10 cents.

RP1565. Color designations for lights. Kenneth L. Kelly. Price 5 cents.

RP1566. Iron as a tanning agent. Joseph R. Kanagy and Ruth A. Kronstadt. Price 5 cents.

### Commercial Standard[2]

CS111–43. Earthenware (vitreous-glazed) plumbing fixtures. Price 5 cents.

### Technical News Bulletin[2]

Technical News Bulletin No. 320, December 1943. Price 5 cents. Annual subscription, 50 cents.

## MIMEOGRAPHED MATERIAL

### Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC736. Liquid densities of eleven hydrocarbons found in commercial $C_4$ mixtures.

LC737. List of published material relating to home building and maintenance. (Supersedes LC647).

LC738. Notes on domestic fuel-oil conservation.

LC739. Service tests of some oil-treated sole leathers.

LC740. Metallurgy: Publications by members of the staff of the National Bureau of Standards, 1931–1943. Supersedes LC664).

LC741. Polarimetry and its application to the sugars and their derivatives: Publications by members of the staff of the National Bureau of Standards. (Supersedes LC507).

## RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS[3]

Standard-frequency broadcast service of National Bureau of Standards, United States of America. Anonymous. Proc. Inst. Radio Engineers (330 West 42d St., New York, N. Y.) **31**, 642 (November 1943).

The concept of color. Report of OSA Committee on Colorimetry. J. Optical Soc. Am. (Am. Institute of Phyics, 175 Fifth Ave., New York 10, N. Y.) **33**, 544 (October 1943).

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and in countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

Color designations for lights. Kenneth L. Kelly. J. Optical Soc. Am. 33, 627 (November 1943).

Application of Polya's theorem to structural, geometrical and optical isomers. William J. Taylor, J. Chem. Phys. (Am. Institute of Physics, 175 Fifth Ave., New York 10, N. Y.) 11, 532 (November 1943).

Natural rubber and synthetic rubber. Conference of November 5, 1943. Norman Bekkedahl. Pamphlet published by Instituto Agronomico do Norte, Balem, Para, Brasil (November 1943).

The importance of building codes. George N. Thompson. Discussion in pamphlet entitled "Building codes, an essential tool in urban development" published by Chamber of Commerce of the United States (1615 H. St., N. W., Washington, D. C.) (December 1943).

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